

DEPARTMENT OF COMMERCE  
BUREAU OF STANDARDS  
WASHINGTON, D.C.

Mar. 1, 1924.

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REPORTS AND PAPERS RELATIVE TO THE INVESTIGATION OF AUTOMOTIVE  
POWER PLANTS, BUREAU OF STANDARDS.

(The publications not starred may be secured through the National Advisory Committee for Aeronautics, 3341 Navy Bldg., 17th & B Sts., N. W., Washington, D. C. Those marked with a star are publications of the Bureau of Standards and may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the prices stated. In addition, references are given to a number of papers published in various technical journals.)

N. A. C. A. Technical Reports

| Number | Title   |
|--------|---|
| 43     | Synopsis of Aeronautic Radiator Investigations for the years 1917 and 1918. (42)  |
| 44     | The Altitude Laboratory for the Testing of Aircraft Engines. (52)   |
| 45     | Effect of Compression Ratio, Pressure, Temperature, and Humidity on Power. Part I. Variation of Horsepower with Altitude and Compression Ratio (7); Part II. Value of Supercharging (9); Part III. Variation of Horsepower with Temperature (8); Part IV. Influence of Water Injection on Engine Performance (34); (Out of print. May be consulted at leading libraries.) |
| 46     | A Study of Airplane Engine Tests.   |
| 47     | Power Characteristics of Fuels for Aircraft Engines. Part I. Power Characteristics of Aviation Gasoline (11); Part II. Power Characteristics of Sumatra and Borneo Gasolines (33); Part III. Power Characteristics of 20% Benzol Mixture (32).  |
| 48     | Carbureting Conditions Characteristic of Aircraft Engines (10).   |

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| Number | Title   |
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| 49     | Metering Characteristics of Carburetors: Part I. Description of Carburetor Test Plant (43); Part II. Discharge Characteristics of Fuel Metering Nozzles in Carburetors (44); Part III. Characteristics of Air Flow in Carburetors (45); Part IV. Effects of Pulsating Air Flow in Carburetors (46); Part V. Natural Metering Characteristics of Carburetors (47); Part VI. Control of Carburetor Metering Characteristics for Aircraft Service. |
| 51     | Spark Plug Defects and Tests: Part I. Causes of Failure of Spark Plugs (22); Part II. Gas Leakage in Spark Plugs (21); Part III. Methods for Tests of Spark Plugs (17).   |
| 52     | Temperature in Spark Plugs having Brass and Steel Shells.   |
| 53     | Properties and Preparation of Ceramic Insulators for Spark Plugs: Part I. Methods of Measuring Resistance of Insulators at High Temperatures (18); Part II. Electrical Resistance of Various Insulating Materials at High Temperatures (19); Part III. Preparation and Composition of Ceramic Bodies for Spark Plug Insulators (23); Part IV. Cements for Spark Plug Electrodes (35).   |
| 54     | Effect of Pressure and Temperature on the Sparking Voltage (14).  |
| 56     | Heat Energy of Various Ignition Sparks: Part I. Method of Measuring Heat Energy of Ignition Sparks (15); Part II. Measuring of Heat Energy per Spark of Various Ignition Systems (13).  |
| 57     | The Subsidiary Gap as a Means for Improving Ignition (31).  |
| 58     | Characteristics of High-Tension Magnetos: Part I. Operation Cycles of Jump Spark Ignition Systems (20); Part II. Transformation Ratio and Coupling in High Tension Magnetos (16).   |
| 59     | General Analysis of Airplane Radiator Problems (49).  |
| 60     | General Discussion of Test Methods for Radiators (37).  |

1. The first part of the report deals with the general situation of the country and the progress of the work during the year. It is a summary of the work done by the various departments and the results of the various projects.

2. The second part of the report deals with the financial situation of the country and the progress of the work during the year. It is a summary of the work done by the various departments and the results of the various projects.

3. The third part of the report deals with the administrative situation of the country and the progress of the work during the year. It is a summary of the work done by the various departments and the results of the various projects.

4. The fourth part of the report deals with the educational situation of the country and the progress of the work during the year. It is a summary of the work done by the various departments and the results of the various projects.

5. The fifth part of the report deals with the health situation of the country and the progress of the work during the year. It is a summary of the work done by the various departments and the results of the various projects.

6. The sixth part of the report deals with the social situation of the country and the progress of the work during the year. It is a summary of the work done by the various departments and the results of the various projects.

7. The seventh part of the report deals with the economic situation of the country and the progress of the work during the year. It is a summary of the work done by the various departments and the results of the various projects.

8. The eighth part of the report deals with the cultural situation of the country and the progress of the work during the year. It is a summary of the work done by the various departments and the results of the various projects.

9. The ninth part of the report deals with the political situation of the country and the progress of the work during the year. It is a summary of the work done by the various departments and the results of the various projects.

10. The tenth part of the report deals with the international situation of the country and the progress of the work during the year. It is a summary of the work done by the various departments and the results of the various projects.

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| 61     | Head Resistance due to Radiators: Part I. Head Resistance of Radiator Cores (6); Part II. Preliminary Report on Resistance due to Nose Radiator (24); Part III. Effect of Streamline Casing for Free-Air Radiators (27). |
| 62     | Effect of Altitude on Radiator Performance. (29)   |
| 63     | Results of Tests on Radiators for Aircraft Engines; Part I. Heat Dissipation of Radiators (50); Part II. Water Flow Through Radiators. (33).   |
| 87     | Effect of Nature of Cooling Surface on Radiator Performance. (51)  |
| 88     | Pressure Drop in Radiator Tubes. (59)  |
| 89     | Comparison of AlcoGas Aviation Fuel with Export Aviation Fuel. (68)  |
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| 102    | Performance of a Liberty 12 Airplane Engine (71)   |
| 103    | Performance of a 300 Horsepower Hispano Suiza Airplane Engine. (72)  |
| 106    | Turbulence in the Air Tubes of Radiators for Aircraft Engines. (90)  |
| 107    | A High Speed Engine Pressure Indicator of the Balanced Diaphragm Type. (69)  |
| 108    | Some Factors of Airplane Engine Performance. (83)  |
| 123    | Simplified Magneto Mathematics. (97)   |
| 134    | Performance of Maybach 300 Horsepower Airplane Engine.   |
| 135    | Performance of B. M. W. 185 Horsepower Airplane Engine.  |
| 168    | A Constant Pressure Bomb.  |

1. The following information is being furnished to you for your information only. It is not to be used for any other purpose.

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1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 26

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| Number | Title   |
|--------|---|
| 179    | Notes on the Effect of Electrode Temperature on the Sparking Voltage of Short Spark Gaps. |
|        | Correcting Engine Horsepower Measurements to a Standard Temperature. (In Press)           |
|        | Effect of Spark Character on Flame Velocity (In Press)                                    |
|        | Relation of Air-Fuel Ratio to Engine Performance (In Press)                               |

N. A. C. A. Technical Notes

| Number | Title   |
|--------|---|
| 14     | Increase in Maximum Pressures Produced by Preignition in Internal Combustion Engines. |
| 26     | A Variable Speed Fan Dynamometer  |
| 27     | Instrument for Measuring Engine Clearance Volumes.                                    |
| 32     | Causes of Cracking of Ignition Cable.   |
| 39     | High-Thermal Efficiency in Airplane Service.  |
| 55     | "Airplane Crashes: Engine Troubles". A Possible Explanation.                          |
| 93     | Background of Detonation.   |
| 108    | Use of Multiplied Pressures for Automatic Altitude Adjustment.                        |
| 162    | Arithmetic of Distribution.   |

Bureau of Standards Publications

| Number | Title  | Price |
|--------|--|-------|
| *C 92  | Operation and Care of Batteries.....   | 30¢   |
| *T 143 | A Study of the Deterioration of Nickel Spark Plug Electrodes in Service..... | 10¢   |

1. The first part of the report is a general  
 introduction to the subject of the study.  
 2. The second part is a detailed description of the  
 methods used in the study.  
 3. The third part is a discussion of the results of the study.  
 4. The fourth part is a conclusion of the study.

| TABLE I  |  |  |  |
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| 1. The first part of the report is a general introduction to the subject of the study. | 2. The second part is a detailed description of the methods used in the study. | 3. The third part is a discussion of the results of the study. | 4. The fourth part is a conclusion of the study.         |
| 5. The fifth part is a list of references.   | 6. The sixth part is a list of figures.  | 7. The seventh part is a list of tables.                       | 8. The eighth part is a list of appendices.              |
| 9. The ninth part is a list of footnotes.  | 10. The tenth part is a list of endnotes.                                      | 11. The eleventh part is a list of errata.                     | 12. The twelfth part is a list of acknowledgments.       |
| 13. The thirteenth part is a list of abbreviations.                                    | 14. The fourteenth part is a list of symbols.                                  | 15. The fifteenth part is a list of units.                     | 16. The sixteenth part is a list of definitions.         |
| 17. The seventeenth part is a list of terms.   | 18. The eighteenth part is a list of concepts.                                 | 19. The nineteenth part is a list of theories.                 | 20. The twentieth part is a list of models.              |
| 21. The twenty-first part is a list of hypotheses.                                     | 22. The twenty-second part is a list of predictions.                           | 23. The twenty-third part is a list of conclusions.            | 24. The twenty-fourth part is a list of recommendations. |
| 25. The twenty-fifth part is a list of suggestions.                                    | 26. The twenty-sixth part is a list of comments.                               | 27. The twenty-seventh part is a list of criticisms.           | 28. The twenty-eighth part is a list of praises.         |
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The above table is a summary of the contents of the report. It is intended to provide a quick overview of the report's structure and content. The table is organized into four columns, each representing a different section of the report. The first column contains the section number, the second column contains the section title, the third column contains the section description, and the fourth column contains the section page number.



Letter Circular--Mar. 1, 1924

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| Number | Title  | Price |
|--------|--|-------|
| *T 146 | Cadium Electrode for Storage Battery Testing.....  | 5¢    |
| *T 149 | Estimation of Nitrates and Nitrites in Battery Acid.....   | 5¢    |
| *T 155 | Cements for Spark Plug Electrodes. (Same as N.A.C.A. Technologic Report 53, Part IV).....  | 5¢    |
| *T 186 | Oscillograph Measurements of the Instantaneous Values of Current and Voltage in the Battery Circuit of Automobiles. (Similar to Society of Automotive Engineers Journal, Paper, April 1921)..... | 10¢   |
| *T 211 | Radiators for Aircraft Engines.....  | 60¢   |
| *S 424 | The Mathematical Theory of Induced Voltage in the High Tension Magneto.....  | 15¢   |
| *S     | A Method of Determining the Dew Points of Air-Fuel Mixtures. (In Press).....   |       |

Journal References

| Title  | Journal   | Date           |
|--|---|----------------|
| Methods of Measuring Conductivity of Insulating Materials at High Temperatures | Journal of Washington Academy of Sciences   | May 4, 1919.   |
| Ignition Work at the Bureau of Standards                                       | Automotive Industries   | June 12, 1919. |
| Deterioration of Nickel Spark Plug Terminals in Service                        | Bulletin 152, Am.Inst. Mining & Metallurgical Engineers. (Same as B. of S. T 143, above). | August 1919.   |
| The Design of Cooling Surface for Air-Cooled Engines                           | Automotive Industries   | June 10, 1920  |
| Flying an Airplane Engine on the Ground  | S. A. E. Journal  | April 1920     |

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| Title  | Journal   | Date  |
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| The Velocity of Flame Propagation in Engine Cylinders        | S. A. E. Journal  | February 1920                                   |
| Fuel Economy of Automotive Engines                           | S. A. E. Journal  | April 1919                                      |
| Dilution of Engine Lubricants by Fuel                        | S. A. E. Journal  | February 1920                                   |
| Monel Metal For Engine Valves                                | Automotive Industries<br>Aerial Age                           | April 15, 1920<br>May 17, 1920                  |
| Preignition and Spark Plugs                                  | S. A. E. Journal  | February 1920                                   |
| Motor Transport Corps Spark Plug Specifications              | S. A. E. Journal  | May, 1920                                       |
| Intake Manifold Temperatures and Fuel Economy                | S. A. E. Journal  | August 1920                                     |
| Design Factors for Airplane Radiators                        | S. A. E. Journal  | June 1920                                       |
| Possible Fuel Savings in Automotive Engines                  | S. A. E. Journal<br>Sci. Monthly                              | January 1921<br>February 1921                   |
| Instantaneous Current and Voltage Values in a Battery        | S. A. E. Journal  | April 1921                                      |
| Resume of Bureau of Standards Fuel Study                     | S. A. E. Journal  | May 1921  |
| Compression Ratio and Thermal Efficiency of Airplane Engines | S. A. E. Journal  | May 1921  |
| Elements of Automobile Fuel Economy                          | S. A. E. Journal<br>Automotive Industries                     | June 1921<br>June 9 & 30, 1921.                 |
| Radiators for Aircraft Engines                               | Journal Washington<br>Academy of Sciences<br>S. A. E. Journal | Vol.II-No. 17<br>Oct. 19, 1921<br>Oct. 19, 1921 |

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| Title   | Journal                                  | Date   |
|---|--|--|
| Developing a Method for Testing Brake Linings   | S.A.E. Journal                           | March 1922   |
| Relative Performance of Motor Transportation  | S.A.E. Journal                           | Nov. 16, 1922  |
| Testing Fuels for High Compression Engines  | S.A.E. Journal                           | January 1923   |
| Economic Motor Fuel Volatility  | S.A.E. Journal                           | (February & July 1923 and March 1924.  |
| Glucose as an Anti-Freeze Solution  | Automotive Industries                    | Apr. 12, 1923  |
| Automobile Headlighting Equipment   | Automotive Industries                    | July 12, 1923  |
| Fuel Requirements of Internal Combustion Engines  | Jour. Ind. Eng. Chem.                    | May 1923   |
| An Investigation of Some Heavy-Duty Truck Drive Axles   | S.A.E. Journal                           | June 1923  |
| A Note on the Relation Between the Traffic Capacity of Highways and the Effectiveness of Vehicle Brakes | Automotive Industries                    | Aug. 30, 1923  |
| Decelerometer for Testing Brakes  | S.A.E. Journal                           | December 1923  |
| A Description of Decelerometer  | Automotive Industries                    | (Nov. 29, 1923 (page 1091 (Dec. 15, 1923 (page 1196 (Jan. 31, 1924 (page 213 |
| Test of Brake Performance   | S.A.E. Journal<br>Automotive Industries  | January 1924<br>March 13, 1924   |
| Bureau of Standards Improves Brake Lining Test Apparatus  | Automotive Industries                    | Jan. 17, 1924  |
| Service Tests of Lubricants in Automobile Engines   | American Petroleum Institute Bulletin 73 |  |



Circulars

- LC 3 Reclamation of Used Lubricating Oils
- LC 28 Preliminary Report on Anti-Freeze Solutions for Automobile radiators.
- LC 35 Publications Relating to Petroleum Products.
- Carburetor Adjustment for Alcohol and Alcohol-Gasoline Blends.
- Notes on Benzol-Gasoline Mixtures for Automobile Fuels
- Fire and Explosion Hazard in Filtering Gasoline.
- Gasoline Improvers.

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is crucial for ensuring transparency and accountability in the organization's operations.

2. The second part of the document outlines the specific procedures and protocols that must be followed when conducting financial transactions. It details the steps for approval, execution, and documentation of these transactions.

3. The third part of the document addresses the role of the internal audit function. It explains how the internal audit team is responsible for monitoring and evaluating the organization's internal controls and risk management processes.

4. The fourth part of the document discusses the importance of regular communication and reporting between the various departments and the management team. It highlights the need for timely and accurate information to support decision-making.

5. The fifth part of the document provides a summary of the key points discussed and reiterates the commitment to maintaining high standards of integrity and ethical behavior throughout the organization.